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EXAMINER	
LEWIS, BEN	
ART UNIT	**PAPER NUMBER**
1745	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/091,821	Applicant(s) BECKMANN ET AL.	
	Examiner Ben Lewis	Art Unit 1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 8/24/06.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 38-45,51,52 and 54 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 38-45,51,52 and 54 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 06 March 2002 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Detailed Action

1. The Applicant's amendment filed on August 24th, 2006 was received. Claim 54 was amended. Claims 1-37, 46-50, 53 and 55 were cancelled.

2. The text of those sections of Title 35, U.S.C. code not included in this action can be found in the prior Office Action (issued on May 16th, 2006).

Claim Rejections - 35 USC § 102

3. Claims 38 and 39 are rejected under 35 U.S.C. 102(e) as being anticipated by Wilkinson et al. (U.S. Patent No. 6,682,839 B2).

With respect to claims 38 and 39, Wilkinson et al teach that fuel cell stack **10** is depicted schematically, showing various layers of the stack without showing the housing, internal manifolds, or sealing mechanisms which prevent intermixing of reactants. FIG. 1 illustrates the stacked electrochemically active layers of three electrochemical fuel cell assemblies. In particular, for each fuel cell assembly, these layers are the electrolyte **20**, a cathode **22**, and an anode **24**, all disposed between a pair of flow field plates, which are also known as separator plates **26**. A single separator plate **26** may be shared between two adjacent fuel cell assemblies. The electrochemically active area of the fuel cells is defined by a cathode electrocatalyst **28** disposed at an interface between electrolyte **20** and cathode **22** and an anode

electrocatalyst **30** disposed at an interface between electrolyte **20** and anode **24**. In a preferred embodiment, electrolyte layer **20** comprises an ion exchange membrane. Oxidant supply subsystem **32** and heat transfer liquid supply subsystem **42**, supply an oxidant fluid stream comprising an oxidant and a heat transfer liquid to oxidant supply manifold **34**. Oxidant supply manifold **34** is shown as an external manifold for illustrative purposes, but an internal manifold passing through the thickness of the layers of fuel cell stack **10** is also a preferred embodiment. Oxidant supply manifold 34 directs the oxidant fluid stream to oxidant fluid passages of each of the individual fuel cell assemblies (Col 8 lines 39-67). Fuel supply subsystem **38** supplies a fuel stream to fuel supply manifold **40**. Fuel supply manifold **40** is shown as an external manifold for illustrative purposes, but an internal fuel supply manifold is also a preferred embodiment. Fuel supply manifold **40** directs the fuel stream to fuel fluid passages and anode electrocatalyst **30** of each of the individual fuel cell assemblies. The fuel stream may be exhausted from stack **10**, recirculated, or dead-ended, depending on the fuel and the desired mode of operation. However, even for dead-ended operation, an exhaust manifold **39** is typically provided so that the fuel fluid passages may be periodically purged by opening a purge valve (not shown in FIG. 1) which is closed during dead-ended operation. Valve **41** may be used to shut off the fuel supply stream and/or to regulate the amount of fuel supplied to fuel cell stack **10**. (Col 9 lines 30-55).

With regard to air and fuel being introduced into said anode chamber Wilkinson et al teach that approximately 1% air was added to the fuel fluid stream supplied to the

anode. In this experiment, the fuel fluid stream was not re-circulated. FIG. 9 shows data from this experiment (Col 1 lines 50-67).

With respect to claims 40 and 42, Wilkinson et al teach that valve **6** may be used to shut off the oxidant supply stream and/or to control the amount of oxidant supplied to fuel cell stack **10**. Oxidant supply subsystem **32** typically comprises a purification unit and a blower or compressor. The purification unit may comprise, for example, filters for removing particulate contaminants from air, which may be the source of the oxidant supply stream. In some applications, such as space vehicles or submarines, the oxidant may be supplied from a pressure vessel that contains air or substantially pure oxygen under pressure (Col 9 lines 4-15). With respect to a load connected across the fuel cell such that the system functions in an electricity generating mode Wilkinson et al teach that to improve the viability of fuel cells as a commercial power source, it is generally desirable to improve the power density of the stack, that is, to reduce the stack dimensions and weight for a given electrical power output capability (Col 1 lines 55-65). Therefore the fuel cell of Wilkinson et al is used to supply power to a load.

With respect to claim 41, Wilkinson et al teach that Fuel supply subsystem **38** supplies a fuel stream to fuel supply manifold **40**. Fuel supply manifold **40** is shown as an external manifold for illustrative purposes, but an internal fuel supply manifold is also a preferred embodiment. Fuel supply manifold **40** directs the fuel stream to fuel fluid passages and anode electrocatalyst **30** of each of the individual fuel cell assemblies. The fuel stream may be exhausted from stack **10**, recirculated, or dead-ended, depending on the fuel and the desired mode of operation. However, even for dead-ended operation, an exhaust manifold **39** is typically provided so that the fuel fluid passages may be periodically purged by opening a purge valve (not shown in FIG. 1) which is closed during dead-ended operation. Valve **41** may be used to shut off the fuel supply stream and/or to regulate the amount of fuel supplied to fuel cell stack **10**. (Col 9 lines 30-55).

With respect to claim 43, Wilkinson et al teach that valve **6** may be used to shut off the oxidant supply stream and/or to control the amount of oxidant supplied to fuel cell stack **10**. Oxidant supply subsystem **32** typically comprises a purification unit and a blower or compressor. The purification unit may comprise, for example, filters for removing particulate contaminants from air, which may be the source of the oxidant supply stream. In some applications, such as space vehicles or submarines, the oxidant may be supplied from a pressure vessel that contains air or substantially pure oxygen under pressure (Col 9 lines 4-15). The instant specification recites: "said water

generator/DMFC 61 can be used to generate water by: 1) introducing excess fuel (in proportion to the demand of the attached load) to a DMFC of standard design and materials; or 2) introducing fuel to a to water generator/DMFC 61t without a load being connected between the anode and cathode aspects of the water generator/DMFC 61. By doing so, fuel crossover is promoted, and fuel that passes through the PCM is oxidized without generating electricity, thus forming additional water in the cathode chamber 67 of the water generator/DMFC 61. It may be further possible to intentionally vary said load attached to water generator/DMFC 61 periodically in order to periodically induce fuel crossover, and resulting generation of water" (Paragraph 0041).

Wilkinson et al do not specifically teach a load is uncoupled and not connected across the fuel cell such that there is fuel crossover and the system functions in a water genenrationg mode at the cathode chamber. However, it is the position of the examiner that such properties as fuel crossover and water generation at the cathode chamber of a direct methanol fuel cell are inherent, given that Wilkinson et al and the present application utilize a direct methanol fuel cell with air and fuel being fed to the anode. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

4. Claims 51-54 are rejected under 35 U.S.C. 102(e) as being anticipated by Knights et al. (U.S. Patent No. 6,210,820 B1).

With respect to claims 51-54, Knights et al. teach a method for operating fuel cells on impure fuels wherein electrochemical fuel cells convert reactants, namely fuel and oxidant, to generate electric power and reaction products. Electrochemical fuel cells generally employ an electrolyte disposed between two electrodes, namely a cathode and an anode. An electrocatalyst typically induces the desired electrochemical reactions at the electrodes. In addition to electrocatalyst, the electrodes may also comprise a porous electrically conductive sheet material, or "electrode substrate", upon which the electrocatalyst is deposited. The electrocatalyst may be a metal black, an alloy or a supported metal catalyst, for example, platinum on carbon. Solid polymer electrolyte fuel cells employ a membrane electrode assembly ("MEA") which comprises a solid polymer electrolyte or ion-exchange membrane disposed between the two electrode layers (Col 1 lines 20-40). A preferred embodiment of a fuel cell system equipped to introduce a variable amount of oxygen into the fuel stream directed to the fuel cells in the system is shown in the schematic diagram of FIG. 1. The system comprises a solid polymer fuel cell stack **1** and a fuel processor **2** comprising a reformer. A supply of fuel **3** “second opening” (e.g., methanol) provides feedstock to the reformer. The fuel is reformed and processed, generating a hydrogen rich but impure fuel stream comprising a significant concentration of carbon monoxide impurity. The impure fuel stream is supplied to the fuel inlet **5** of the fuel cell stack **1**. A supply of oxidant **4** “first opening” (e.g., compressed air) is supplied to the oxidant inlet **6** of the fuel cell stack **1**. As depicted, the fuel and oxidant streams supplied to the fuel cell stack **1** are exhausted at fuel and oxidant outlets **7** and **8** respectively. The system also

comprises an oxygen supply and a flow controller **10** for introducing a variable amount of oxygen into the fuel stream upstream of the fuel cell stack at **11**. For simplicity, the oxygen supply is preferably air, obtained via a bleed line **9** branching off the oxidant stream supplied to the fuel cell stack **1** (Col 5 lines 40-67).

The instant specification recites: "said water enerator/DMFC 61 can be used to generate water by: 1) introducing excess fuel (in proportion to the demand of the attached load) to a DMFC of standard design and materials; or 2) introducing fuel to a to water generator/DMFC 61t without a load being connected between the anode and cathode aspects of the water generator/DMFC 61. By doing so, fuel crossover is promoted, and fuel that passes through the PCM is oxidized without generating electricity, thus forming additional water in the cathode chamber 67 of the water generator/DMFC 61. It may be further possible to intentionally vary said load attached to water generator/DMFC 61 periodically in order to periodically induce fuel crossover, and resulting generation of water" (Paragraph 0041).

Knights et al do not specifically teach detachably connecting a load across said membrane electrode assembly. However, it is the position of the examiner that such properties as fuel crossover and water generation at the anode and cathode chamber of a direct methanol fuel cell are inherent, given that Knights et al and the present application utilize a direct methanol fuel cell with air and fuel being fed to the anode. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. <u>In re Robertson</u>, 49 USPQ2d 1949 (1999).

Claim Rejections - 35 USC § 103

5. Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wilkinson et al. (U.S. Patent No. 6,682,839 B2) as applied to claims 38-43 above and further in view of Tillmetz et al. (U.S. Patent No. 6,410,175 B1).

With respect to claim 45, Wilkinson et al teach that fuel cell stack in paragraph 17 above. Wilkinson et al do not specifically teach coupling to a second fuel cell to deliver water to the anode of said second fuel cell. However, Tillmetz et al discloses a fuel cell system with improved starting capability wherein, FIG: 3 shows another embodiment of a fuel cell system **30** which also includes first and second fuel cell stacks **21**, **22**, a fuel processing subsystem **29** comprising a reformer **23**, and a methanol reservoir **24**, each of which is similar in construction and operation to those shown in FIG. 2. However, a starting fluid reservoir **26** comprising a supply of starting fluid is included and a different procedure may be followed with regards to water reservoir **25**. In FIG. 3, during start-up, a starting fluid is provided directly from starting fluid reservoir **26** through valve **28a** to fuel inlet **21a** of the first fuel cell stack **21**. Feedstock for the reformer is provided by the controlled mixing of methanol from methanol reservoir **24** and water from water reservoir **25** at junction **27b**. Again, the feedstock is directed to reformer inlet **23a**. Here, a supply of water for the water reservoir **25** is obtained from the product water generated by the operating first and/or second fuel cell stacks **21**, **22**. Thus, water from

first stack outlet **21b** and second stack outlet **22b** is collected and directed into water reservoir **25**. At system shutdown, the water reservoir **25** may be emptied so as to avoid freezing. In this embodiment, it may be possible to rely on the production of water from the first stack **21** during start-up to prepare a sufficient amount of aqueous feedstock for the reformer, after which production of water is used from both stacks **21**, **22** after start-up (Col 6 lines 55-67); (Col 7 lines 1-20). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the water from the first stack into the second stack of Tillmetz et al into the fuel cell system of Wilkinson et al because Tillmetz et al teach that it may be possible to rely on the production of water from the first stack **21** during start-up to prepare a sufficient amount of aqueous feedstock for the reformer, after which production of water is used from both stacks **21**, **22** after start-up (Col 7 lines 1-20)

6. Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wilkinson et al. (U.S. Patent No. 6,682,839 B2) as applied to claims 38-43 above and further in view of Grasso et al. (U.S. Patent No. 6,475,652 B1).

With respect to claim 45, Wilkinson et al teach that fuel cell stack in paragraph 17 above. Wilkinson et al do not specifically teach the system further comprising a load being a variable load that can be used to periodically induce fuel crossover, resulting in generation of water. However, Grasso et al. teach a fuel cell power plant wherein in operation of PEM fuel cells, it is critical that a proper water balance be maintained between a rate at which water is produced at the cathode electrode including water

resulting from proton drag through the PEM electrolyte and rates at which water is removed from the cathode and at which water is supplied to the anode electrode. An operational limit on performance of a fuel cell is defined by an ability of the cell to maintain the water balance as electrical current drawn from the cell into the external load circuit varies and as an operating environment of the cell varies. For PEM fuel cells, if insufficient water is returned to the anode electrode, adjacent portions of the PEM electrolyte dry out thereby decreasing the rate at which hydrogen ions may be transferred through the PEM and also resulting in cross-over of the reducing fluid leading to local over heating. Similarly, if insufficient water is removed from the cathode, the cathode electrode may become flooded effectively limiting oxidant supply to the cathode and hence decreasing current flow. Additionally, if too much water is removed from the cathode, the PEM may dry out limiting ability of hydrogen ions to pass through the PEM, thus decreasing cell performance (Col 1 lines 60-67);(Col 2 lines 1-20). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the varying of an external load of Grasso et al in to the fuel cell system of Wilkinson et al because Grasso et al teach that an operational limit on performance of a fuel cell is defined by an ability of the cell to maintain the water balance as electrical current drawn from the cell into the external load circuit varies and as an operating environment of the cell varies. For PEM fuel cells, if insufficient water is returned to the anode electrode, adjacent portions of the PEM electrolyte dry out thereby decreasing the rate at which hydrogen ions may be transferred through the

PEM and also resulting in cross-over of the reducing fluid leading to local over heating (Col 1 lines 60-67).

Response to Arguments

7. Applicant's arguments filed on August 24th, 2006 have been fully considered but they are not persuasive.

Applicant's principal arguments are

(a) Wilkinson does not teach an opening allowing air introduction into the anode chamber (which can be used for the purpose of generating water at the anode), as in Applicant's claimed invention.

(b) Knights does not teach Applicant's claimed features of providing a first opening for the introduction of oxygen into said anode chamber, and a second opening allowing introduction of said fuel into said anode chamber, and detachably connecting a load across said membrane electrode assembly.

(c) Knights reference does not appear to generate water at the anode by introducing fuel and oxygen into the anode chamber.

(d) Tillmetz teaches nothing about specifically generating water at the anode as in applicant's claimed invention for allowing introduction of fuel into said anode chamber, such that when air and fuel are introduced into said anode chamber, fuel is oxidized on said anode aspect into water and carbon dioxide, said anode chamber further including an opening through which carbon dioxide exits such that said system functions to generate water.

(e) Tillmetz is also silent on Applicant's further feature of a coupling to a second fuel cell to deliver water to the anode of said second fuel cell.

In response to Applicant's arguments, please consider the following comments.

(a) and (d) With regard to air and fuel being introduced into said anode chamber Wilkinson et al teach that approximately 1% air was added to the fuel fluid stream supplied to the anode. In this experiment, the fuel fluid stream was not re-circulated. FIG. 9 shows data from this experiment (Col 1 lines 50-67).

(b) and (c) Knights teach that the system comprises a solid polymer fuel cell stack **1** and a fuel processor **2** comprising a reformer. A supply of fuel **3** "second opening" (e.g., methanol) provides feedstock to the reformer. The fuel is reformed and processed, generating a hydrogen rich but impure fuel stream comprising a significant concentration of carbon monoxide impurity. The impure fuel stream is supplied to the fuel inlet **5** of the fuel cell stack **1**. A supply of oxidant **4** "first opening" (e.g., compressed air) is supplied to the oxidant inlet **6** of the fuel cell stack **1**. As depicted, the fuel and oxidant streams supplied to the fuel cell stack **1** are exhausted at fuel and oxidant outlets **7** and **8** respectively. The system also comprises an oxygen supply and a flow controller **10** for introducing a variable amount of oxygen into the fuel stream upstream of the fuel cell stack at **11**. For simplicity, the oxygen supply is preferably air, obtained via a bleed line **9** branching off the oxidant stream supplied to the fuel cell stack **1** (Col 5 lines 40-67).

The instant specification recites: "said water generator/DMFC 61 can be used to generate water by: 1) introducing excess fuel (in proportion to the demand of the attached load) to a DMFC of standard design and materials; or 2) introducing fuel to a to water generator/DMFC 61t without a load being connected between the anode and cathode aspects of the water generator/DMFC 61. By doing so, fuel crossover is promoted, and fuel that passes through the PCM is oxidized without generating electricity, thus forming additional water in the cathode chamber 67 of the water generator/DMFC 61. It may be further possible to intentionally vary said load attached

to water generator/DMFC 61 periodically in order to periodically induce fuel crossover, and resulting generation of water" (Paragraph 0041).

Knights et al do not specifically teach detachably connecting a load across said membrane electrode assembly. However, it is the position of the examiner that such properties as fuel crossover and water generation at the anode and cathode chamber of a direct methanol fuel cell are inherent, given that Knights et al and the present application utilize a direct methanol fuel cell with air and fuel being fed to the anode. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

(e) Wilkinson et al do not specifically teach coupling to a second fuel cell to deliver water to the anode of said second fuel cell. However, Tillmetz et al discloses a fuel cell system with improved starting capability wherein, FIG. 3 shows another embodiment of a fuel cell system **30** which also includes first and second fuel cell stacks **21**, **22**, a fuel processing subsystem **29** comprising a reformer **23**, and a methanol reservoir **24**, each of which is similar in construction and operation to those shown in FIG. 2. However, a starting fluid reservoir **26** comprising a supply of starting fluid is included and a different procedure may be followed with regards to water reservoir **25**. In FIG. 3, during start-up, a starting fluid is provided directly from starting fluid reservoir **26** through valve **28a** to fuel inlet **21a** of the first fuel cell stack **21**. Feedstock for the reformer is provided by the controlled mixing of methanol from methanol reservoir **24**

and water from water reservoir **25** at junction **27b**. Again, the feedstock is directed to reformer inlet **23a**. Here, a supply of water for the water reservoir **25** is obtained from the product water generated by the operating first and/or second fuel cell stacks **21**, **22**. Thus, water from first stack outlet **21b** and second stack outlet **22b** is collected and directed into water reservoir **25**. At system shutdown, the water reservoir **25** may be emptied so as to avoid freezing. In this embodiment, it may be possible to rely on the production of water from the first stack **21** during start-up to prepare a sufficient amount of aqueous feedstock for the reformer, after which production of water is used from both stacks **21**, **22** after start-up (Col 6 lines 55-67); (Col 7 lines 1-20). Therefore it would have been obvious to one of ordinary skill in the art to use the water from the first stack into the second stack of Tillmetz et al into the fuel cell system of Wilkinson et al because Tillmetz et al teach that it may be possible to rely on the production of water from the first stack **21** during start-up to prepare a sufficient amount of aqueous feedstock for the reformer, after which production of water is used from both stacks **21**, **22** after start-up (Col 7 lines 1-20)

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben Lewis whose telephone number is 571-272-6481. The examiner can normally be reached on 8:30am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's Trainer, Susy Tsang-Foster can be reached on 571-272-1293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Ben Lewis

Patent Examiner
Art Unit 1745

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